POPULATION DYNAMICS OF ASSASSIN BUGS FROM PENINSULAR INDIA (INSECTA–HETEROPTERA–REDUVIIDAE)[1]

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(With four text-figures)

Data on the population dynamics of *Acanthaspis pedestris* Stal and *Ectomocoris tibialis* Distant from Chandrapuram, a semi-arid zone. *A. pedestris* from Maruthamalai scrub jungles and *Lophocephala guerini* Laporte from Walayar, a tropical rain forest, were collected for a period of two years and analysed. Population dynamics of sixteen species belonging to four sub-families attracted to light in a typical agroecosystem in Coimbatore was also studied. In all the conditions of collection, the influence of meteorological factors on the population density of these bugs appeared to be negligible. The reduviid population fluctuations have a direct correlation to the prey population fluctuation in the semi-arid zones and scrub jungles. These studies indicate that *L. guerini* is bivoltine whereas others are either univoltine (*E. tibialis*) or multivoltine (*A. pedestris*).

INTRODUCTION

Assassin bugs are efficient predators, except for one species, namely *Lophocephala guerini* Laporte, and many of them are predating on insect pests. By virtue of their trophic status and their potential to regulate population of other insects, especially the insect pests, assassin bugs play an important role in both community ecology and pest control. This prompted us to investigate the population dynamics of these bugs. The present paper reports on the population dynamics of tropical rainforest, coprophagous, myrmecophiline *L. guerini* and two scrub jungle and semi-arid zone predaceous assassin bugs, namely *Acanthaspis pedestris* Stal and *Ectomocoris tibialis* Distant, and sixteen species of light-attracted assasin bugs (all predaceous) in an agrosystem.

Meteorological factors do not significantly influence the population density of these bugs, but predaceous reduviid population fluctuations have a direct correlation to the prey population fluctuations in the semi-arid zone and scrub jungles.

MATERIAL AND METHODS

Six individual microhabitats were selected at random from Chandrapuram semi-arid zone, Maruthamalai scrub jungle in Tamil Nadu and Walayar tropical rain forest at the Tamil Nadu-Kerala border. In microhabitats, assassin bugs were counted (*A. pedestris* and *E. tibialis* in Chandrapuram, *A. pedestris* in Maruthamalai and *L. guerini* in Walayar) underneath 25 to 30 stones, which form a single observation unit. Fortnightly collection records of the population of males, females as well as nymphal instars were maintained and meteorological recordings were registered simultaneously over a period of two years. The camouflaging behaviour of *A. pedestris* presented considerable difficulty in assessing their population in the field and they were therefore not taken into account.

In Maruthamalai and Chandrapuram the approximate density of population of camponotine ants in the respective habitats was also taken into account concurrently, since these ants form the staple food of *A. pedestris* and *E. tibialis*. In the Walayar tropical rain forest the population of various nymphal instars of *L. guerini* could be readily recorded more precisely due to their contrasting coloration among the life stages. The

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nymphs have dark violaceous black dorsal abdominal bands of different lengths for different stages. Since *L. guerini* is a myrmecophiline assassin bug, the appropriate population level of the formicine ant *Anoplolepis longipes* Jerdon was also taken into consideration. In order to appreciate the restricted distribution of these bugs underneath the stones within an area less than 100 sq. m, an area of nearly 6 sq. km adjacent to the microhabitat was intensively surveyed.

In order to establish a possible migratory phenomenon observed in *A. pedestris* and *E. tibialis*, marking experiments were carried out at regular intervals (with both Indian ink & Camlin white ink). A light trap was set up in a typical agroecosystem at Coimbatore to find out the population dynamics of light attracted reduviids. The light trap collections were examined each morning and records were maintained systematically.

Results

Chandrapuram semi-arid zone; As far as the two predaceous assassin bugs, namely *A. pedestris* and *E. tibialis* of the semi-arid zone are concerned, the level of population in one area is by and large regulated by the density of population of camponotine ants in that area. Even though a marked decline in population was recorded following high humidity and rainfall, it was observed that physical factors such as temperature, humidity and rainfall have apparently no effect on the level of population of the two assassin bugs (Fig. 1).

In Chandrapuram the peak population was recorded in July 1977. In 1978, too, from June to August both the species recorded a similar peak. This suggests that the peak population of these two species remains constant during June-August, when the meteorological conditions are moderate. Significantly, the camponotine ant (prey) population too registered a high peak during this period. A sharp decline in the population during October-November is significant. Correspondingly, there was a sharp fall in the camponotine population, but a steep rise in relative humidity following heavy rain causing flooding of microhabitats. These observations suggest that the paucity of camponotine ants was indirectly correlated to the depletion of the predating reduviid populations both equally affected by climatic adversities. The predominance of females in almost all the collection is significant, suggesting that the field population of these reduviids is female biased.

Maruthamalai Scrub Jungle: In Maruthamalai, *A. pedestris* registered a brief rise during November and December 1976; the highest peak was recorded in September 1977. During the months of March, June and December in 1977 and May, June, November and December in 1978, the population was found to be at its lowest ebb. Nevertheless, it is found that there is no direct correlation between any of the meteorological factors and the population level of these bugs in this scrub jungle habitat. As in the semi-arid zone, the field population here too is apparently female biased and on only one occasion (September 1977), when the camponotine ant population was normally high, was the sex ratio found to be equal. Here too, the fall in the level of reduviid population corresponds to the depletion of camponotine ant population (Fig. 2).

Walayar tropical rain forests.: In April, when there was a steady rise in temperature and humidity, the sex ratio of *Lophocephala guerinii* was found to be almost equal (though female-biased). In the following months a decrease in temperature and an increase in relative humidity bring about a steep rise in the population of first instar nymphs and a significant dip in the female population. In January, when the temperature was relatively low, there was high percentage of female population, almost double that of males and the population of first instar nymphs remained high. In 1977 January, however, due to inexperience in nymph detection the data were not accurately kept. In other months, the population appeared erratic as far as the sex ratio was concerned. April 1977 registered a high population of both fifth instars and adults and the sex ratio was more or less same in the adults (Fig. 3).

Since the biology of this species is not worked out under laboratory conditions due to its myrmecophilic life and coprophagous feeding habits, the significance of such patterns of changes in population cannot be adequately explained. The low population in other months, when the temperature and humidity did not register a drastic change, may be attributed to these insects going deeper into crevices as the gut contents of none of the co- habiting predaceous fauna are found to contain any remnants of *L. guerini*. The chance of migration is also ruled out by the negative results of the intensive search in the adjacent areas. Though these insects are alate, they are only short distance fliers. We also dug out some ant nests and recorded large number of these bugs in deeper parts of the ant nest.

L. guerini is a first record of a myrmecophiline and coprophagous reduviid (Ambrose & Livingstone 1979). *A. longipes* is the formicine ant that co-inhabit the crevices. They are found to congregate around the adults and nymphs of *L. guerini* and are also found to escort them to and fro during the feeding march. Though congregation of *A. longipes* in the microhabitat of *L. guerini* is the indication of the population of the latter, it is not a rule because in several localities where *A. longipes* congregate there is no sign of *L. guerini*. Therefore, the population of *A. longipes* and that of *L. guerini* are not complementary. But it is worthwhile to mention here that the tropical rain forests of the Western Ghats have a distribution of *L. guerini* also in very restricted pockets. Conditions in these habitats are also similar to those recorded in Walayar. The presence of the congregation of some species of ants in and around *L. guerini* in these habitats is also significant.

Light trap: Analysis of the data gathered from the light trap collections of 16 species of assassin bugs from a particular locality in an agroecosystem adjacent to the scrub jungles and semi-arid zones, has shown apparently no correlation between any perceptible fluctuations in the meteorological factors and population level (Fig. 4).

The maximum collection was made in July 1978, when the climatic conditions were found to be moderate. In December 1978, when the maximum rainfall, was recorded only one assassin bug (*Ectomocoris cordatus* Wolff) was found attracted to light. And in general, August and September appear to be the lean period for the night activity of the alate reduviids.

Among the four subfamilies represented in the collection, Piratinae species are found to be the most abundant (9 species) followed by Stenopedinae (5 species). Acanthaspidinae and Harpactorinae are represented by only one species each. Fig.4 indicates that species of Piratinae have been collected throughout the year with a maximum record of twelve assassin bugs in a collection. Out of all the nine species of Piratinae five belong to the genus *Ectomocoris*. The Piratinae sp. and *Sirthenea flavipes* Stal were collected only once, in March 1978 and July 1978 respectively. Among Piratinae *Ectomocoris cordatus* Wolff is the most abundant form followed by *E. quadriguttatus* Fabricius. All the five species of Stenopodinae, namely *Oncocephus fuscinotum* Reuter, *O. klug* Distant, *O. modestus* Reuter, *O. notatus* Klug and *Sastrapada baerensprungi* Stal have been recorded between March-July 1978 and January-June 1979 and totally absent between August-December 1978.

All the other subfamilies were found to be more specific in their occurrence. Acanthaspidinae, represented by only one species, namely *Pasira perpusilla* Walk. was collected only once (February 1978). Harpactorine species, namely, *Polididus armatissimus* Stal was collected in May and June 1978 and March and June 1979. It is significant to note the sporadic occurrence of this Harpactorine species in June 1978 collection.

None of these species collected has shown any correlation between their occurrence and meteorological factors, though temperature aparently has some influence in their periodicity.

Discussion

The foregoing information suggests that in all the conditions of collection, the influence of

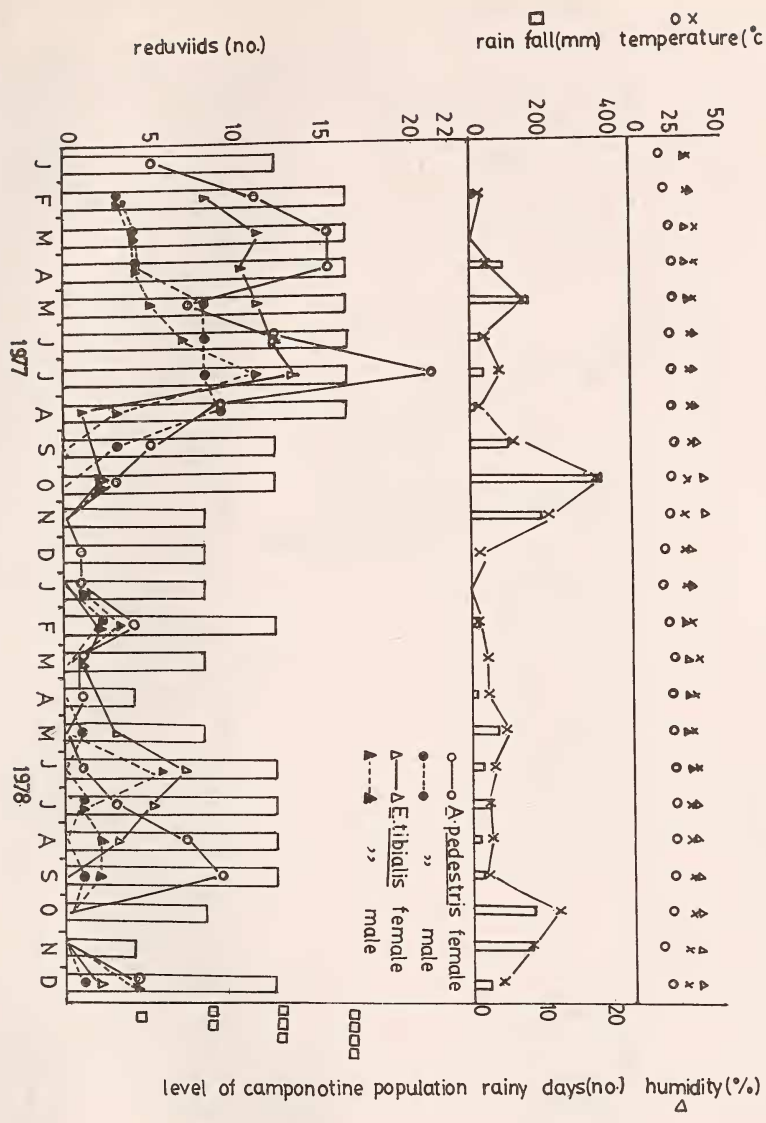

Fig. 1. Population dynamics of *A. pedestris* and *E. tibialis* in Chandrapuram semiarid zone.

meteorological factors on the population density of these bugs appears to be negligible. The fluctuations have direct correlations to the prey population fluctuations in the semi-arid zones and scrub jungles. It is also significant that the natural reduviid population in the semi-arid zone is female biased. This may be correlated to the development of cannibalistic tendency, the females preying upon the males soon after copulation and also to the shorter life span of the males

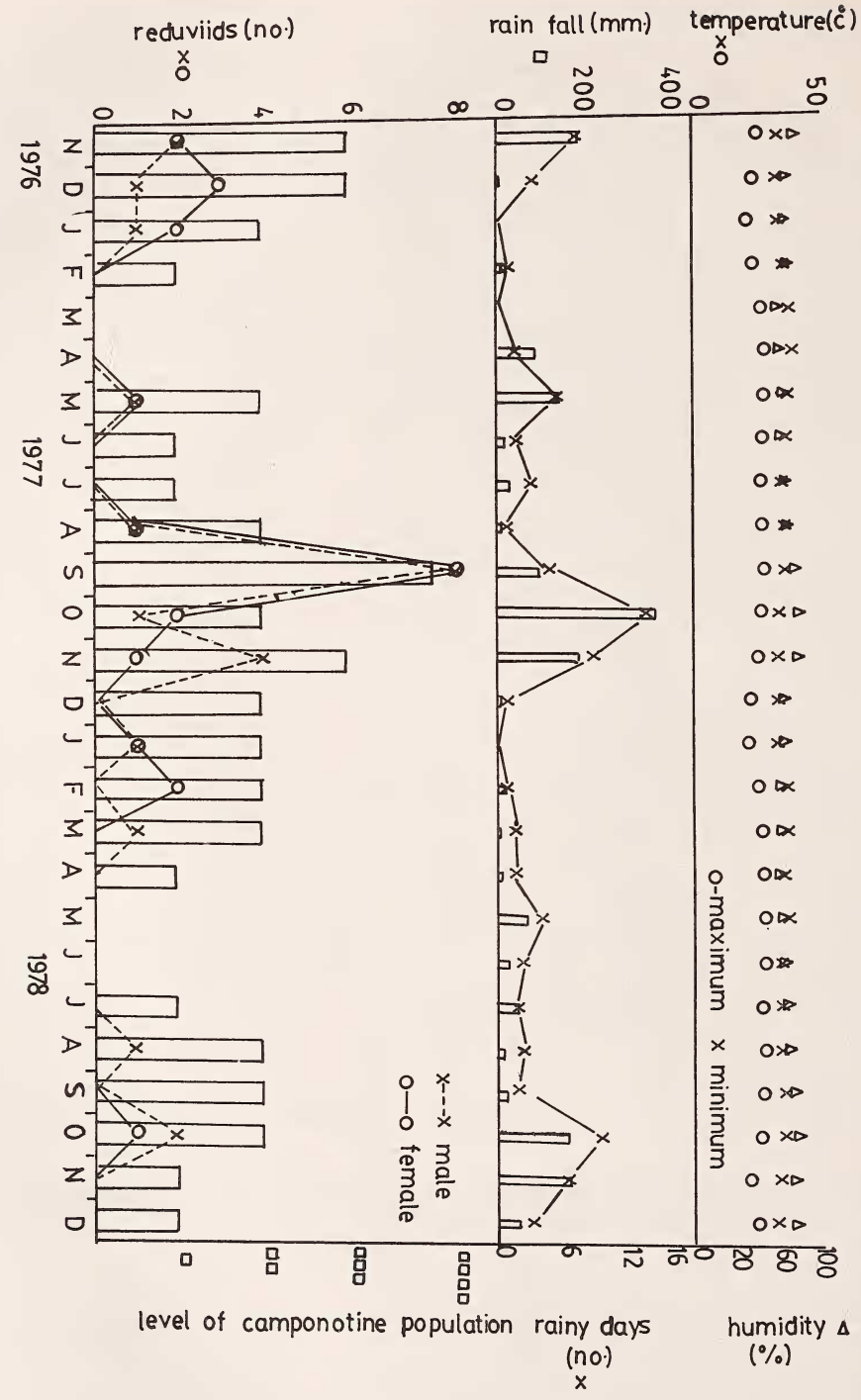

Fig. 2. Population dynamics of *A. pedestris* in Maruthamalai scrub jungle.

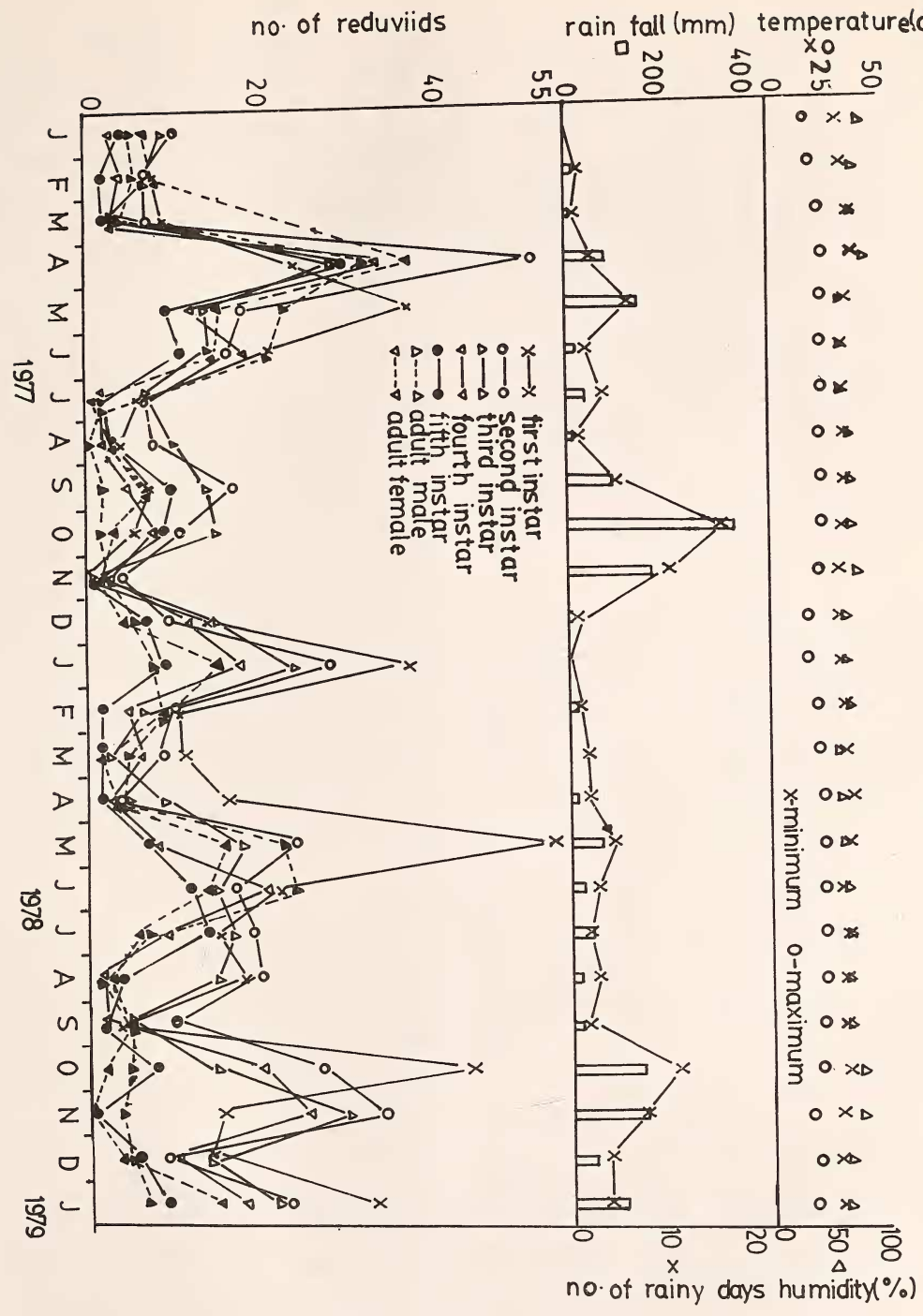

Fig. 3. Population dynamics of *L. guerini* in Walayar tropical rain forest.

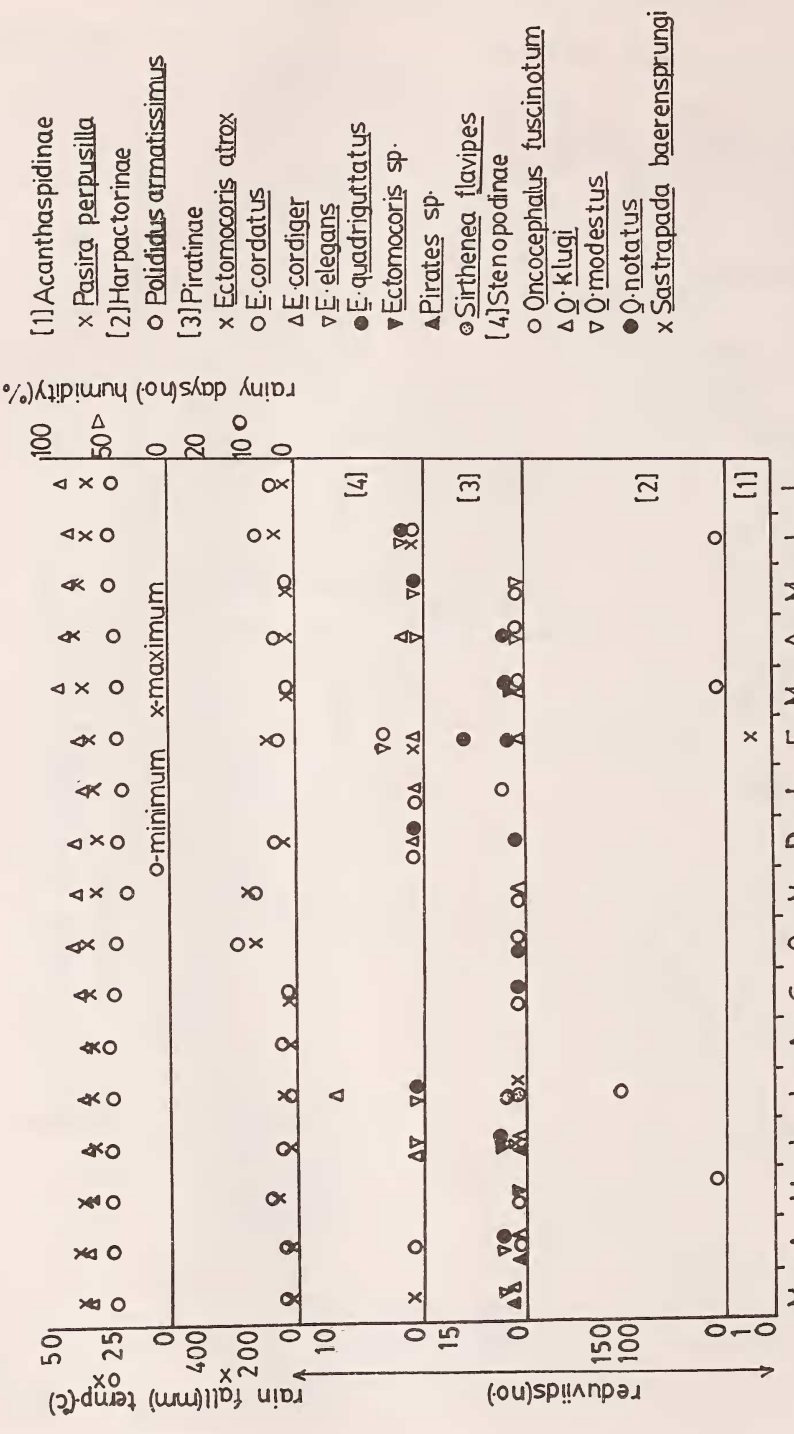

Fig. 4. Population dynamics of light attracted reduviids collected from an agroecosystem.

(Ambrose & Livingstone, 1978 a).

In the scrub jungles, when the camponotine population was relatively very high the sex ratio was found to be equal and *Acanthaspis pedestris* has been found to be cannibalistic, often the females predating upon the males, only when they are subjected to starvation. It is also evident that the predatory species migrate from place to place in search of their prey, when the population of latter is depleted in one particular period (Ambrose & Livingstone 1978 b). This may be the reason why the predators are totally absent when the prey is absent.

Nicholson (1958) and Clark *et al.* (1978) have considered the density of the prey population as the primary factor in controlling the population level of predators. Andrewartha and Birch (1969) have noted that the dispersal of the predators is correlated to the migration in search of prey. Milne (1957 a, b) has proposed the theory that the prey population is a density dependent factor for a predator and the present study corroborates Milne's theory. Reduviid population in the scrub jungle and semi-arid zones is dependent on camponotine ant population. Chitty (1960) maintains that the population level in a habitat is kept constant by the genetic factors of the species concerned. Pimentel (1961) considers this as a genetic feedback in the maintenance of population level of a particular species. Population studies of reduviids of different microhabitats indicate that *L. guerini* is bivoltine whereas others are either univoltine (*E. tibialis*) or multivoltine (*A. pedestris*). Since their population dynamics is not apparently regulated by climatic conditions, the authors are tempted to favour the genetic factor in population dynamics as a supplementary factor operating as a regulatory mechanism proposed by Chitty (1960) and Pimental (1961).

Goel (1978) from his lunar periodicity population count mechanisms, reported a high catch of hemipterans when there was high humidity and low rainfall. He further reported maximum collection of reduviids in the month of July. In the present investigations also, it was found that the maximum catch of reduviids has been in July.

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